

Chamundeshwari layout

L-179.20m
Main Road
L-80.70m
L-79.60m
Vijaykumar house Rd

Siri Vana Estate
ಸಿರಿ ವನ
ಎಸ್ಟೇಟ್

ಬಿ.ಎಂ.ಸಿ.
ಲಾಂಡ್...

Raj biryani

Sri Chamundeshwari
Samudaya bavana

SRI BHAVANI
MENS WEAR

Devi Temple
ದೇವಿ ಮಠ
ದೇವಿ ಟೆಂಪಲ್

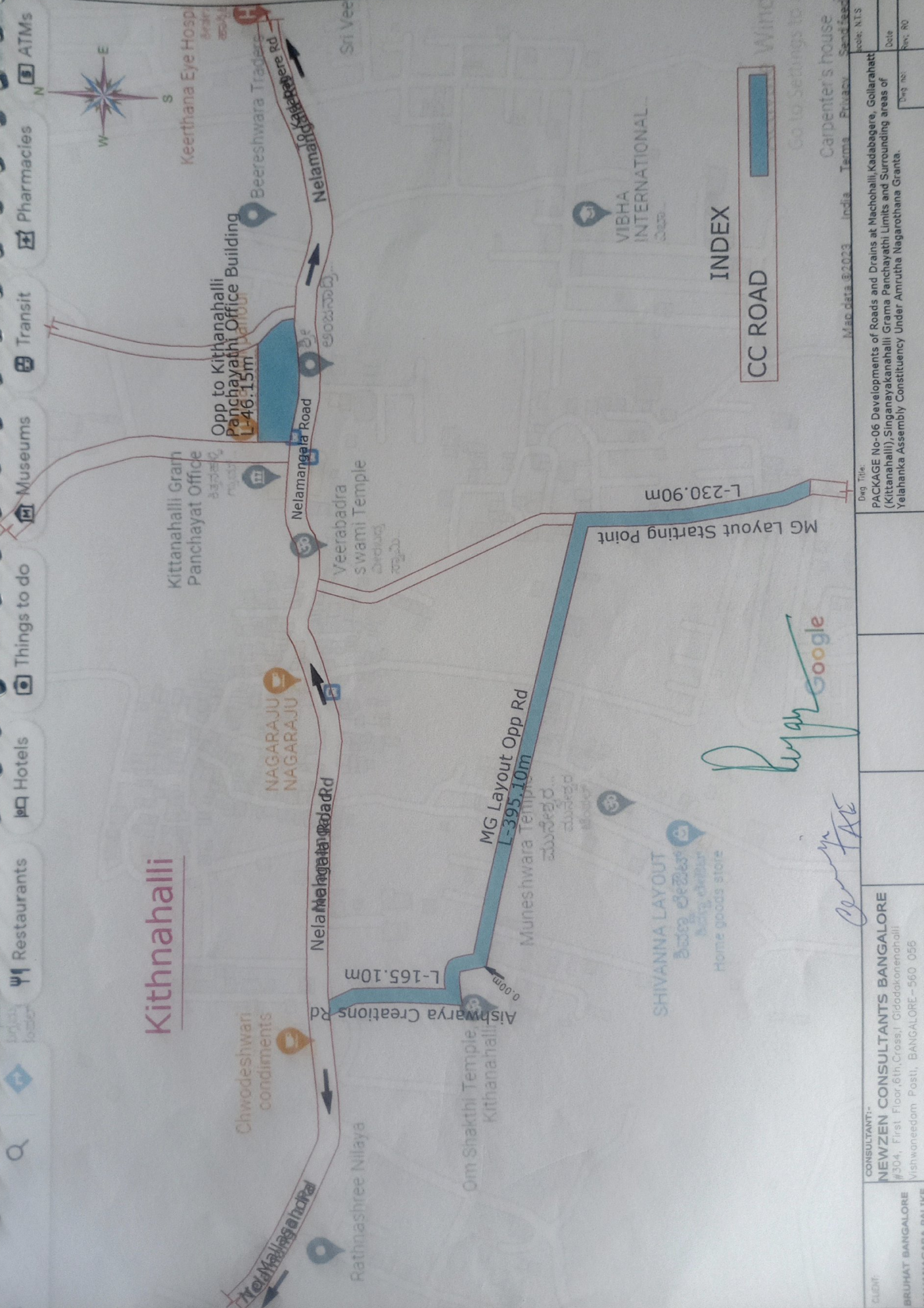
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CC ROAD

Google

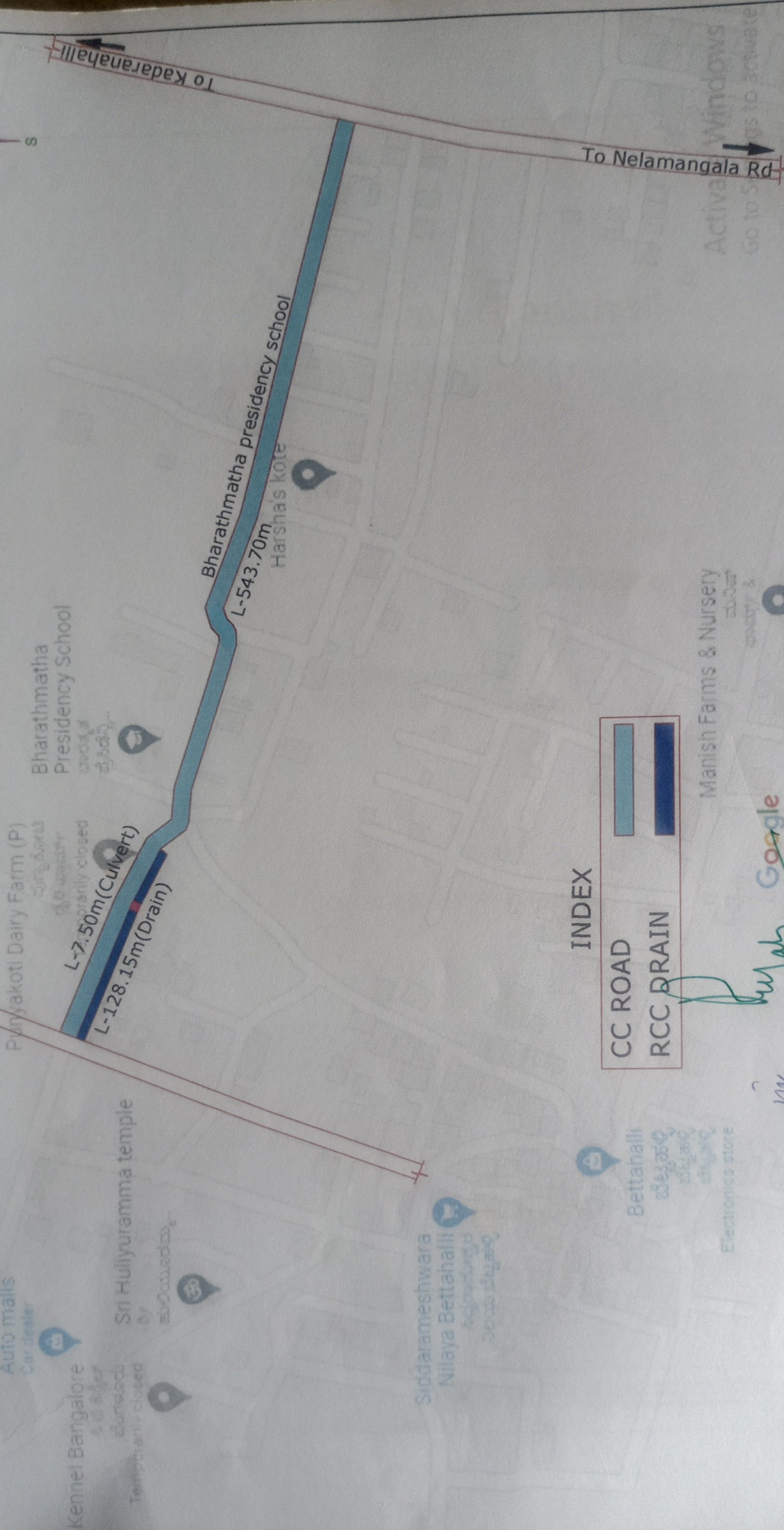
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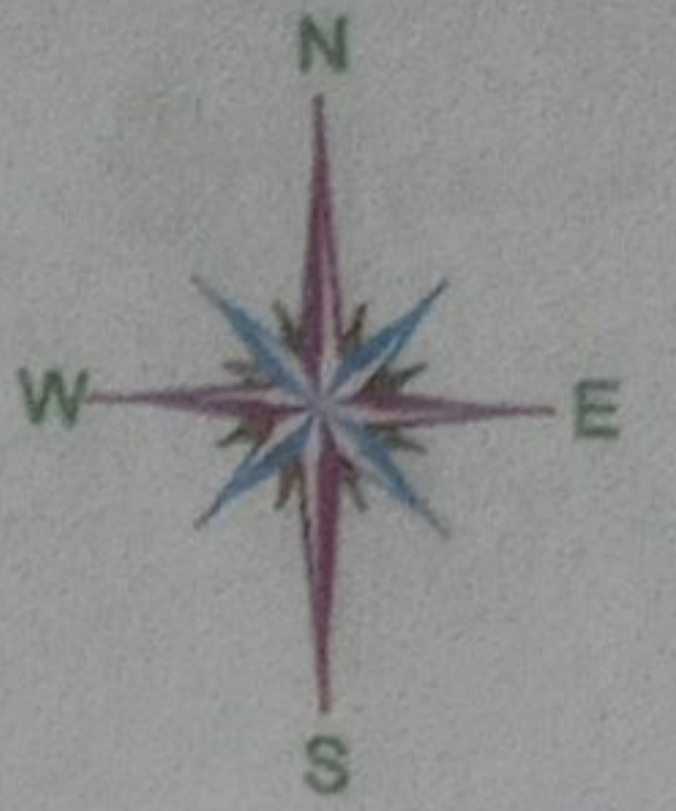
Bettahalli



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Ravuthanahalli

To Tumkur Rd

Connecting Rd -2
L-12.60m

L-100.60 m
Ganga Arasayya House Rd

L-43.50 m
Connecting Rd -1



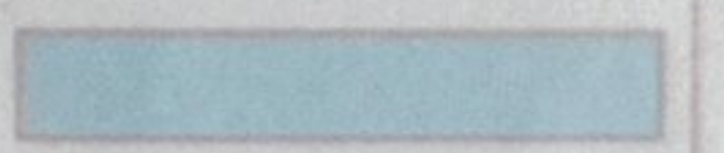
government vet hospital

ಗವರ್ನಮೆಂಟ್
ವೆಟ್ ಹಾಸ್ಪಿಟಲ್

SRIJINNAMBHA
DEVELOPERS

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CC ROAD



To Walmangala Rd

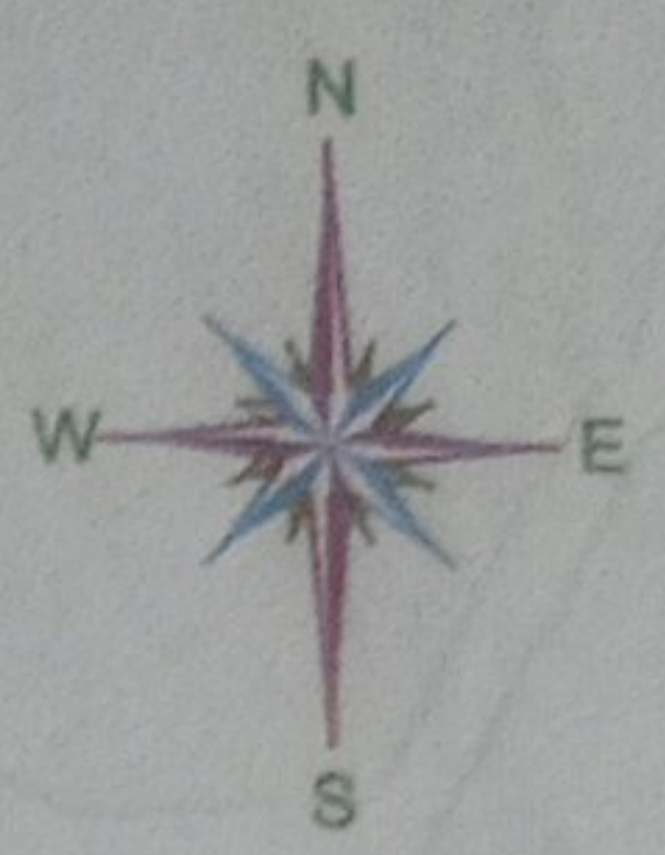
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ANAGARA PALIKE	#304, First Floor, 6th Cross, I Gidodakonenghalli				(Kittanahalli), Singanayakanahalli Grama Panchayathi Limits and Surrounding areas of	Dwg No:
	Vishwoneedam Postli, BANGALORE-560 056	Assistant Engineer	Assistant Executive Engineer	Executive Engineer	Yelahanka Assembly Constituency Under Amrutha Nagarothana Granta.	Rev: RD
	PH- 8792620231, E-mail: newzen5761@gmail.com					

🍴 Restaurants
🏨 Hotels
🎮 Things to do
🏛 Museums
🚉 Transit

Ravuthanahalli



Revanna House Rd
L-109.00m

Ganga Hardware Shop Road
L-201.20m

To KDP Rd

ರಾವುತ್ಥನಹಳ್ಳಿ
ಹಾಲು...

Sri Jinnagaradamma
Lakshmi Devi Gudi

Arasappa House Rd
L-120.00m

Mr site INDEX

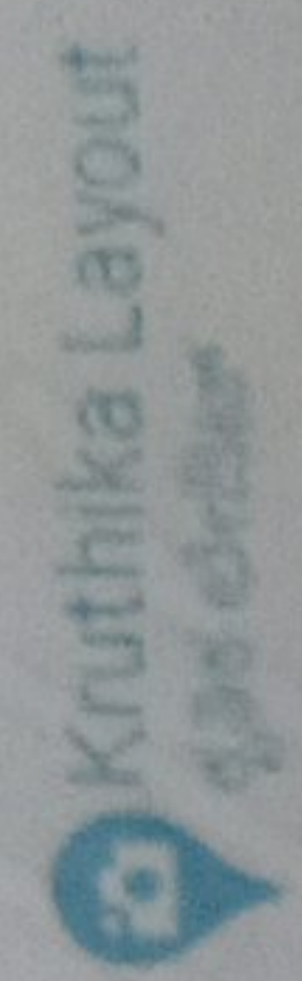
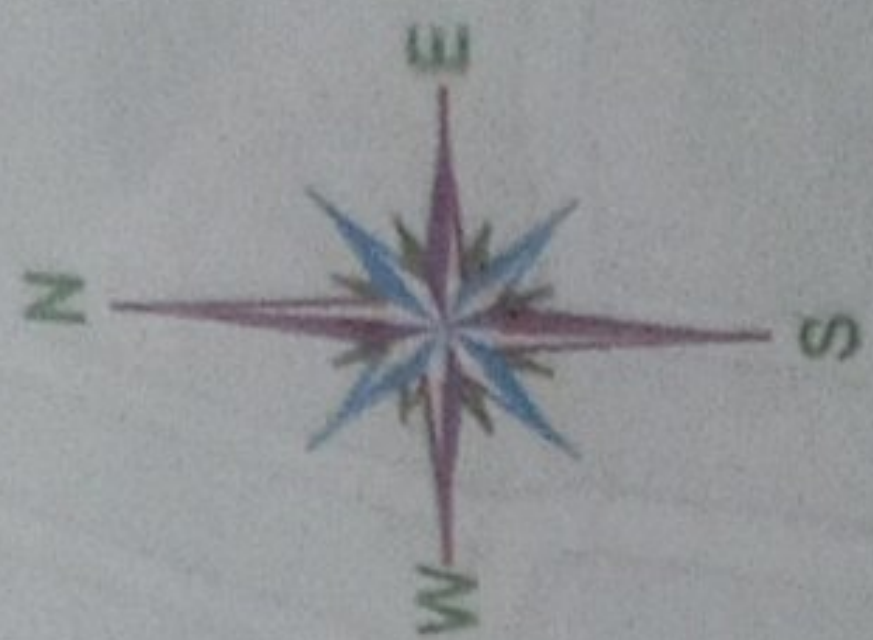
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To Nelamangala Road

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Kadabagere

Kadabagere Panchayat Office

mayee public school

Sri Shiva Shakti Sirdi Sai Baba Mandir

Mulkattamma Devi Temple

Mulkatamma Temple

Manju

the Krafted Backyard

Sri Manjunatha Residency

Sri Mahalaxmi Residency

Narayana Pu College

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CC ROAD

1st Cross
Rajesh House Rd
L-148.60m

Shree Guru photography and...

SRI KK EDUCATION CENTRE

UAP STUDIO



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BRUHAT BANGALORE
MAHANAGARA PALIKE

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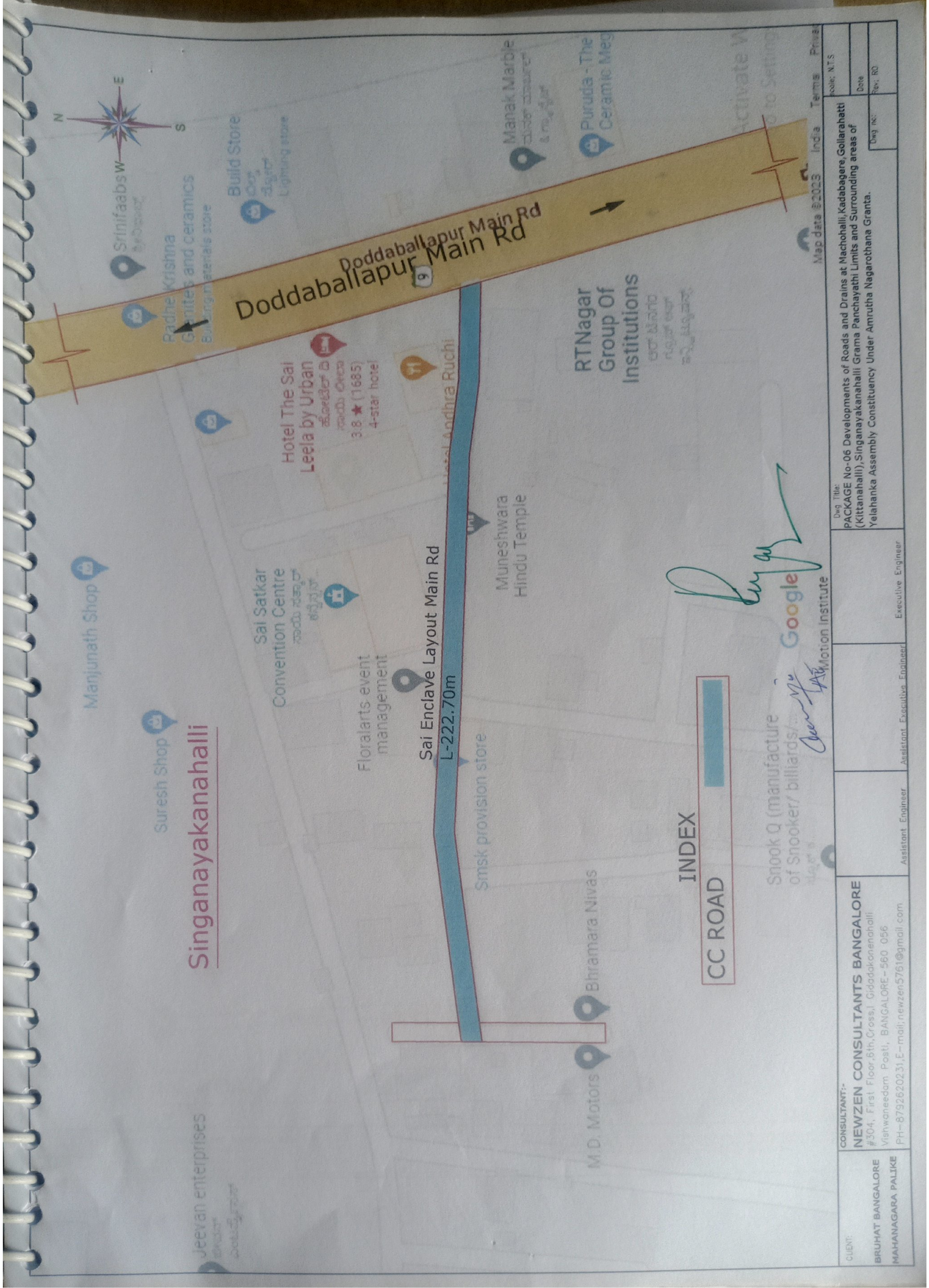
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Dwg no:



Singanayakanahalli

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Chapter -2

ENGINEERING SURVEYS AND INVESTIGATIONS

2.1 General

Various surveys and investigations that are the essential inputs for detailed engineering design are detailed in this chapter. All the relevant maps / data / details available with the concerned departments have been collected, compiled and reviewed. Particular attention has been given to past / historical data / reports. A review of the past data available in the various studies has been listed out and such available data has been made use of, after updating / augmenting the data wherever necessary. The data as collected has been made use of in analysis, design, formulation of improvement proposals and costing. The activities have been performed on several fronts fully complying with the requirements. The activities that are carried out are brought out hereunder.

The various engineering surveys / investigations of the road sections include:

- ❖ Reconnaissance Survey.
- ❖ Visual Topographical Survey.
- ❖ Road Inventory Survey.
- ❖ Pavement Condition Survey.
- ❖ Visual Condition Survey.
- ❖ Structure Condition Survey
- ❖ Soil, geo-technical, material, hydrology and drainage surveys

2.2 Reconnaissance Survey

Reconnaissance Survey of the road, considered for improvements, has been carried out to identify the general condition of roads, drains, culverts and bridges for further surveys / investigations, to understand kind of establishments along the stretches of roads and to work out land acquisition scheme. Making use of the observations / data collected during reconnaissance survey, detailed schedule for surveys / investigations required for the project has been finalized.

2.3 Visual Topographical Survey

Topographic Survey has been conducted all along the corridor by physically measuring the Road Width, Footpath Width, Drain Width, Alignment of Road and with the aid of Google Maps.

2.4 Road Inventory Survey

A detailed inventory and condition survey of road sections has been carried out by making use of well structured inventory data format. It was compiled in tabular form, developed using Excel computer software. Various data collected during the road inventory broadly include.

- ❖ Type of terrain.
- ❖ Land use.
- ❖ Carriageway width.
- ❖ Type of surfacing.
- ❖ Shoulder, Median, Drain (tertiary / shoulder), Footpath - type and width.
- ❖ Road Geometry.
- ❖ Road Furniture.
- ❖ Salient Buildings & Structures.
- ❖ Road Intersection(s) and their details.
- ❖ Land width (RoW).
- ❖ Culverts, bridges and other structures (type, size, span arrangement and location).
- ❖ General drainage conditions.

2.5 Pavement Condition Survey

The Pavement Condition Survey has been carried out in accordance with IRC Guidelines. All surveys and investigations have been carried out with the following objectives:

- ❖ To have an up to date record of road assets.
- ❖ To have a clear understanding of road side features including land use, drainage characteristics, etc. and
- ❖ To assess the condition and strength data for developing improvement proposals and related designs.

2.5.1 Visual Condition Survey

Visual Condition Survey of the road sections has been carried out by travelling along the patching, rutting, pot holes, edge breaking, etc. by visual observations in a well structured data format. The data so collected has been compiled and presented (kilometer wise) in the form of tables for easy understanding. This data has been used to assess the pavement condition.

2.5.2 Soil, geotechnical, material, hydrology and drainage surveys

(i) The activities and Deliverables forming part of the soil, geotechnical, material, hydrology and drainage surveys are described below:

- (a) The characteristics of the existing soil of the Project road.
- (b) The determination of sub grade CBR (soaked) Project road.
- (c) Benkelman Beam Deflection measurements on the Project road for overlay stretches.
- (d) Preliminary hydraulic data for bridges, design discharge, HFL, LWL, etc. with a view to checking adequacy of existing waterway.
- (e) A broad assessment of the drainage condition and requirement of the Project Highway.

(ii) Road signs, safety devices

- (a) The provision of Road Signs, Pavement Markings, Safety Barriers, Railings,

Delineators, Chevron Markings, Traffic Attenuators. It shall also include Crash Barriers for existing bridges.

Chapter -3

DESIGN STANDARD & SPECIFICATION

Chapter -3

DESIGN STANDARD & SPECIFICATION

3.1 General

Planning and design of roads & CD structures, pedestrian facilities and street furniture are essentially based on the IRC standards and MoRT&H specifications. Whenever, the codes / standards are silent on some of the aspects, the same has been planned / designed based on sound engineering practices. Design standards relevant to the project road along with the broad list of design parameters and the relevant IRC codes / specifications have been detailed in Table 3.1.

Table 3.1: Design Standards

SL No.	Design Parameters	Reference Code
1.	Geometric Design Standards • Carriageway width • Shoulder • Footpath • Median • Camber • Super Elevation • Horizontal Alignment • Vertical Alignment	As per IRC: 38 - 1988, IRC: 86 - 1983 & IRC: SP : 23 - 1993
2.	Road Furniture • Road Delineators • Road Markings • Road Signs	As per IRC: 79 - 1981 As per IRC: 35 - 1997 As per IRC: 67 - 2001
3.	Road Capacity	As per IRC: 106 - 1990
4.	Pavement Design	As per IRC: 37 - 2012 & IRC: 58 - 2011
5.	Overlay Design	As per IRC: 81 - 1997
6.	Road Drainage	As per IRC: SP: 42 - 1994 & IRC: SP: 50 - 1999
7.	Culverts	As per relevant IRC codes and MoRT&H

The project road section passes through plain terrain. Design standards (as appropriate) have been further elaborated under the following heads:

- ❖ Geometric Design
- ❖ Pavement Design
- ❖ Overlay Design
- ❖ Drainage
- ❖ Road Furniture and Appurtenances
- ❖ Bridges and CD Structures

3.2 Design Standards Related to Geometric Design

Design standards related to road geometric along with the suggested design values / standards and recommended values based on site conditions and data analysis are detailed in Table 3.2.

Table 3.2: Geometric Design Standards

SL No.	Design Parameters	Design Values
1.	Design Speed	Design speed Considered is 40 kmph.
2.	Geometric Design Standards	
	• Carriageway Width	Two lane/ Four lane carriageway
	• Camber (Bi-directional)	2.5% for paved carriageway.
	• Super Elevation	Limited to 4%.
	• Footpath	Minimum width - 1.5m
	• Kerb	Barrier / Semi — barrier / Mountable (Barrier type recommended)
	• Extra Widening at Curves	Nil for Radius above 300 m
	• Gradient	Maximum Gradient - 4.0 % (1 in 25) Minimum Gradient for Drainage - 0.5 % (desirable minimum) & 0.3 % (absolute minimum).

3.3 Design Standards Related to Pavement Design

Design standards related to Pavement design are essentially based on the guidelines given in IRC: 37 - 2012 "Tentative Guidelines for the Design of Flexible Pavements ". The suggested design values / standards and recommended values based on site conditions and data analysis are detailed in Table 3.3 and are adapted in the design.

Table 3.3: Overlay Design Standards

SL No.	Design Parameters	Reference Code / Design Values
1.	Pavement design	IRC: 37 - 2012 " Tentative Guidelines for the Design of Flexible Pavements "
	Initial Traffic	In terms of CVPD, vehicles weighing more than 3 ton
	Traffic growth rate	5%
	Design Life	10 to 15 years
	Vehicle damage factor	1.5 to 4.5
2.	Soil Characteristics	CBR Value

3.4 Design Standards Related to Overlay Design

Design standards related to Overlay design are essentially based on the guidelines given in IRC: 81 - 1997 "Guidelines for Strengthening of Flexible Road Pavements Using

Benkelman Beam Deflection Technique". The suggested design values / standards and recommended values based on site conditions and data analysis are detailed in Table 3.4 and are adapted in the design.

Table 3.4: Overlay Design Standards

SL No.	Design Parameters	Reference Code / Design Values
1.	Overlay Design	IRC: 81 - 1997 "Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique"
	• Design Life	10 years
	• Correction Factors	Temperature Correction Factor. Correction for Seasonal Variation (inclusive of correction for moisture content, soil type and rainfall)
	• Minimum Thickness	From structural considerations recommended minimum bituminous overlay thickness is 40 mm AC (minimum) or 50mm BM (as required) + 40mm BC
2.	Wearing Course Material (Options)	Bituminous Concrete with Crumb Rubber Modified Bitumen / Plastic Waste.

3.5 Design Standards Related to Road Drainage

Drainage of water from pavement surface is of paramount importance as far as preserving the road assets created by investing huge funds in addition to maintaining the structural soundness and functional efficiency of the road. Design standards related to road drainage are essentially based on the guidelines given in IRC: SP: 42 — 1994 "Guidelines on Road Drainage" and in IRC: SP: 50 - 1999 "Guidelines on Urban Drainage". The suggested design values / standards are detailed in Table 3.5.

Table 3.5: Design Standards Related to Road Drainage

SI No.	Design Parameters	Design Values
1.	• Camber	1.7 - 2.5 % (bi - directional) for carriageway (camber of 3% is adopted).
	• Longitudinal Gradient	Minimum 0.3 - 0.5% for satisfactory drainage
	• Drain Type	Cast in situ RCC box drain with Precast RCC cover slab. RCC box culverts across cross roads.
	• For Existing Drains	Desilting and Rectification of Damaged Portion

3.6 Design Standards Related to Road Furniture and Appurtenances

Utility and importance of the road are greatly enhanced by installing road furniture and appurtenances at appropriate locations along the project road, which ensures improved road safety. Planning and design of road furniture and appurtenances are as per the guidelines

stipulated in IRC. Detailing of each of these components has been done so as to integrate the same with the road improvement scheme. The suggested design values / standards are detailed in Table 3.6.

Table 3.6: Design Standards Related to Road Furniture and Appurtenances

SL No.	Design Parameters	Reference Code / Design Values
1.	Road Markings	IRC: 35 - 1997 "Code of Practice for Road Markings".
2.	Road Signs	IRC: 67 - 2001 "Code of Practice for Road Signs".
3.	Road Delineators	IRC: 79 - 1981 "Recommended Practice for Road Delineators".
4.	Pedestrian Facilities	IRC: 103 - 1988 "Guidelines for Pedestrian Facilities".

In addition to the above measures various other integral road components have been planned so as to achieve the maximum and optimal use of the carriageway with no / least interference to traffic flow at the same time ensuring adequate facilities to other road users especially pedestrians. All the encroachments, if any shall be cleared within the RoW.

3.7 Design Standards Related to Bridges and CD Structures

The design standards and loading considered for culverts and bridges are as stipulated in latest IRC codes / Special publications supplemented by appropriate MOST circulars and/or IS codes. The unsafe and/or deficient bridge and culvert structures (existing) will be rehabilitated or replaced by sound structures.

Chapter -4

DESIGN & PROPOSALS

4.1 General

Improvement proposals for an existing road section essentially consist of two components, geometric and structural improvements. Geometric improvement deals with visible dimensions of roadway, probable road widening and is dictated by the traffic and economic considerations. Due to the inherent restrictions like limitation in land acquisition, limited right of way and existing utilities / services, etc. the horizontal and vertical alignments in general follow the existing geometry except in situations where improvements are possible. The geometric improvements mainly involve improvements to cross sectional elements such as carriageway, shoulders, etc. The structural component deals with the pavement and embankment design aspects, i.e., the ability of the roads to adequately carry and support the Vehicle / wheel loads over the design period. Safety, speed, efficiency, economy and comfort in traffic movement to a large extent are governed by adequacy of design standards used for a specific road facility.

The improvement proposals need to consider the method of widening like concentric or eccentric to the existing road which is dictated by site situations like available land for acquisition, curvature, existing utilities, terrain, places of worship, monuments, grave yards, places of importance etc.

This chapter deals with the analysis of data collected during various engineering surveys/investigations and the formulation of improvement proposals including planning and design.

4.2 Road Inventory and Physical Characteristics of Road Section

Investigations / studies have been carried out along the Project Stretch. Physical characteristics of these road and road Junctions are as follows. The Project area is located thickly populated Residential cum Commercial area. The Project Stretch includes connecting roads and cross roads. For the habitation resided in this area it was very difficult to commute on this stretch in the Rainy season due to non proper flow of water on the Roads and lack of proper drainage facility. By considering these reasons the roads are taken up for Development with Asphaltting or White topping depending upon the site scenario.

Terrain along this section is generally plain. Width of Carriageway (Undivided Carriage Way and Divided Carriage Way) along the Road varies. The Road carries considerable vehicular traffic throughout the day especially during peak hours. Considerable pedestrian traffic is also present along the corridor.

4.3 Pavement Design

Pavement design forms an integral part of detailed engineering study. Performance of pavement is critical as the economical returns are directly dependent on its performance. This chapter deals with the design methodology adopted for the construction, strengthening and rehabilitation of the existing carriageway and the also suggests the design approach for both flexible and rigid pavement for the new carriageway. This chapter also brings out the present condition of the project corridor, the pavement option study and suggests the best alternate design.

This Section describes the studies and investigation carried out on Traffic, existing pavement conditions, existing soil sub grade condition and existing embankment / Soil at OGL condition. New pavements are generally flexible, consisting of Granular Sub-base, Water Mix Macadam, Bituminous macadam and wearing course in Bituminous Concrete.

4.4 Pavement Design Methodology

Pavement design methodology includes two basic functions namely; design of strengthening and Widening for existing pavement and design of new crust for new Pavement to be adopted shall be decided based on life cycle cost analysis as a part of pavement design methodology. Accordingly, the following Methodology has been adopted in Pavement design.

Step 1: Various Pavement investigations have been carried out on the project corridor to assess the adequacy of the existing pavement crust. These investigations include:

- Visual Pavement Condition
- Visual shoulder condition
- BBD measurements
- Sub grade investigations
- Investigations on existing soil / granular layers

Step 2: Detailed material investigations have been conducted in the projected influence area and strength characteristics and availability of construction material has been determined.

Step 3: Design thickness of overlay has been estimated from IRC-81-1997 using estimated traffic level and characteristic deflection of particular homogeneous section. Estimated BM thickness is then adjusted to equivalent thickness of BC & DBM using conversion factors given in IRC 81-1997.

Step 4: Homogeneous sections for pavement design have been established and design traffic Loadings for each of them identified. Design of flexible pavement for new road has been carried out in accordance with guidelines of IRC-37-2012.

4.5 Flexible Pavement Design

4.5.1 Design CBR

Existing soil sub grade samples were collected through Trial Pit excavations at Road and shoulder interface. The existing soil sub grade were tested as per IS 2720.

The equivalent CBR is obtained as per IRC 37-2012 Chart for 905 dependability is 10%. Hence the flexible pavement design has been carried out using the IRC code (IRC-37-2012). In this code, pavement designs have been extended to cover up to 150msa and design CBR strengths up to 15%. In order to compute the damage ratio, the allowable repetitions are calculated in terms of the fatigue and rutting. The pavement design was done as per IRC-37-2012 and IIT Pave software. It accepts layer thickness, loading and material characteristics as inputs and has provisions for entering various indigenous data such as rutting and fatigue coefficients, wheel spacing, tyre pressure etc. The analysis is based on the linear elastic, multilayer theory and the stresses and strains developed in various layers of the pavement are obtained.

4.5.2 Design Life for Base and Sub-base Layers

The stage construction for first five years of pavement life is considered as an option. It would be appropriate to design the bottom non bituminous layers (base and sub-base) for axle loads expected in the 15 year design period the upper bituminous layers for axle loads expected at the end of 10 year design period. A 15-years design life has been considered for Base and Sub-base layers of flexible pavement.

4.5.3 Traffic Considerations

The base year traffic, traffic growth and the projected traffic for the design period for each category of vehicles have been arrived from the Traffic Studies. The commercial vehicle considered for the design are based on the vehicular projections considering the actual traffic, the traffic likely to be generated by future developments in the vicinity of the project road. Further, based on the traffic studies the number of commercial vehicles has been adopted.

4.5.4 Traffic Loading

In accordance with the requirement of IRC: 37-2012, the traffic loading for the design period and design lane are to be assessed. Vehicles constituting the commercial vehicles are LCV, 2 Axles, 3 Axles and Multi Axles and Multi Axle Semi Articulated vehicles.

4.5.5 Design Approach and Criteria of Flexible pavement

Pavement distress resulting from repeated application of traffic;

- Horizontal tensile strain at the bottom of the bituminous layer
- Vertical compressive strain at the top of the Sub grade

4.5.6 Design Standards Related to Pavement Design

Design standards related to pavement design are essentially based on the guidelines given in IRC: 37-2012 – “Tentative Guidelines for Design of Flexible Pavements”.

Table 4. 1 Pavement Design Standards

	Design Parameters	Reference Code / Design Values
1.	Pavement Design	IRC: 37-2012- “Tentative Guidelines for Design of Flexible Pavements”
	Traffic Growth Rate	Adopted as per IRC: 37-2012
	Design Life	10 to 15 years
	Vehicle Damage Factor	Derived values based on Axle load survey. If these values are less than national average, then national average will be used.
	Lane Distribution Factor	As per IRC:37-2012
2.	Wearing Course Material	Bituminous Concrete

4.5.7 Information required for estimating design traffic

- Initial traffic in terms of number of Commercial Vehicles per day (CVPD).
- Traffic growth rate during the design life in percentage.
- Design life in number of years.
- Spectrum of axle loads.
- Vehicle Damage Factor (VDF).
- Distribution of commercial traffic over the carriageway.

4.5.8 Computation of Design Traffic

The design traffic in terms of the cumulative number of standard axles to be carried during the design life of the road should be computed using the following equation:

$$N = \frac{365 * [(1 + r)^n - 1]}{r} * A * D * F$$

Where,

N = Cumulative number of repetitions in terms of million standard axles